Biodegradable anti-cancer treatment micro-robot

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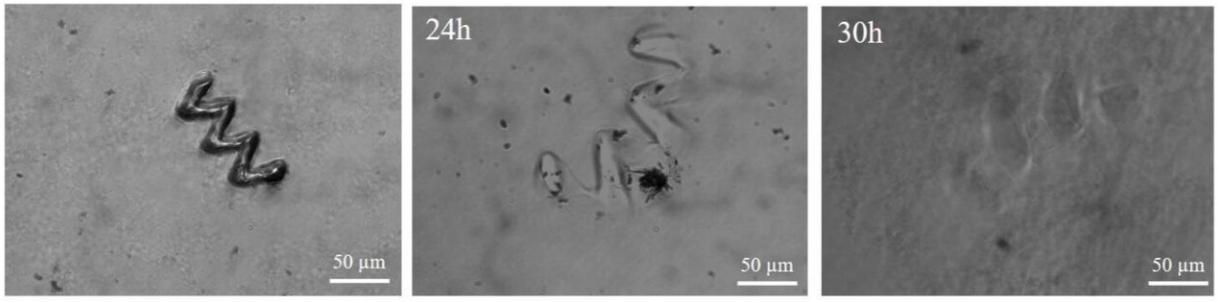

A degradation image of micro-robot along time. Credit: DGIST

Professor Hongsoo Choi's research team in the Department of Robotics Engineering & DGIST-ETH Microrobot Research Center (DEMRC) at DGIST (President Young Kuk) succeeded in developing a biodegradable micro-robot that can perform hyperthermia treatment and control drug release. This research can treat cancer cells through hyperthermia and controlled drug release more precisely and systematically, and is expected to raise the safety and efficiency of anti-cancer treatment.

Anti-cancer treatment is carried out in various ways such as through drugs and hyperthermia, radiation, and surgery. Although drug treatment is the most commonly used method among them, it is difficult to deliver a desired amount accurately to a certain part of the body because it highly depends on the circulatory function. Hyperthermia is difficult to

deliver to a certain body part as well despite its recent popularity due to few side-effects. To overcome these limitations, Professor Hongsoo Choi's research team at DGIST developed 3-D bio-degradable microrobots that can carry magnetic nano particles and drugs through a 3-D laser lithography process.

To use a microrobot inside human body, it must go through an in vivo degradation or be retrieved after use to minimize additional harmful effects. As a result, the research team made a micro-robot with a biodegradable polymer and designed it to be bio-degraded after it is completely used. It can also carry out transport of drugs fast and accurately through wireless control using an external magnetic field.

When a high frequency of alternating magnetic fields is sent to the robot after reaching the desired body part, the heat generated from the magnetic nano particles inside the micro-robot raises the surrounding temperature to perform hyperthermia treatment on the target area. A large achievement of this research is enabling accurate drug release by controlling the intensity and exposure time of alternating magnetic fields. The research team confirmed the significant effectiveness of hyperthermia treatment using micro-robots on cancer cells cultured in vitro, and the therapeutic effects of different drug release modes controlled by alternating magnetic fields.

Professor Choi in the DEMRC said "We expect to improve the treatment of cancer through our research, enhancing the efficiency of cancer treatment and reducing side-effects. By continuously performing a follow-up research with hospitals and related firms, we will strive to develop micro-robot-based precise treatment systems that can be used in actual medical sites."

More information: Jongeon Park et al, Magnetically Actuated Degradable Microrobots for Actively Controlled Drug Release and

Hyperthermia Therapy, *Advanced Healthcare Materials* (2019). DOI: 10.1002/adhm.201900213