Drug Release by Remotely Controlled Magnetic Nanochains

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Great advances in nanomedicine have recently introduced a new concept of activatable drug carrier responsive to external stimuli such as magnetic field, pH, or temperature, rendering accurate drug delivery via remotely controlled on-off switch. Here, as a proof of concept, we introduce mesoporous silica coated super-para-magnetic nanochains (MSPN) for the controlled release of doxorubicin under externally applied "rotating" magnetic field. With this rotating magnetic field, super-para-magnetism of MSPN leads to the corresponding rotating motion of MSPN, of which torque (force) is controlled by tuning the length of MSPN, spontaneously stimulating the activated delivery of encapsulated doxorubicin from the mesoporous silica coating. In our study on cells with MSPN applied with rotating magnetic field, in vitro SEM images showed that cell membrane was physically compromised allowing the drugs to penetrate easily, and MTT assay demonstrated that anti-proliferation effect of MSPN was chain-length-dependent, consequently as designed.