MAGNETIC NANOPARTICLES AND CLUSTERS TO COMBINE MAGNETIC HYPERTHERMIA WITH DIFFERENT THERAPEUTIC APPROACHES

TERESA PELLEGRINO
Fondazione Istituto Italiano di Tecnologia, Genoa, Italy
e-mail: teresa.pellegrino@iit.it

Magnetic hyperthermia" (MHT) is based on the magnetic heat losses of magnetic nanoparticles under an alternating magnetic fields (AMF) with the production of heat to 'burn' tumor cells. This treatment is applied on Glioblastoma patients at magnetic field conditions that are clinically safe (100 kHz and up to 24kA/m). The remote actuation by non-harmful magnetic fields enables to provide a more selective heat treatment with less side effects than traditional hyperthermia approaches. This seminar aims at providing an overview of the main research activities of our group to advance MHT and combine it with different therapeutic modalities. I will first focus on our 5 years progress on nonhydrolytic methods for the preparation of magnetic nanoparticles with optimal heat performance in MHT and our attempt to scale up the production of magnetic materials at very high quality for preserving MHT heat performance. I will then focus on the assembly of magnetic nanoparticles in clusters and correlate their heat efficiency under AMF to the assembly configuration. Next, I will discuss our magnetic semiconductor nano-platforms properly synthesized to combine MHT with internal radiotherapy based on Cupper-64. Then, I will introduce the thermo-responsive polymeric based nanocubes and clusters as drug carrier for chemotherapeutic agents and the heat-mediated drug release based on local hot spots or global temperature increase. I will report about our in vitro study on tumor spheroids from cancer cell model to determine the magnetic hyperthermia effects, with or without the association of chemotherapeutic drugs, on different subpopulations of cancer cells. Finally, I will go through our preclinical on xenograft murine tumor model results to evaluate the magnetic hyperthermia efficacy of some of our magnetic materials and the bio-distribution study of some of the best performing materials we have developed.

Keywords: magnetic hyperthermia, magnetic nanoparticles, chemotherapy, nanoparticles alignment, in vivo efficacy study, Cu64-radiolabelling