Magnetic hyperthermia, chemotehrapy and radiotherapy with inorganic nanoplatforms to tackle cancer

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The use of heat to cure cancer is very ancient. Nowadays, many techniques enable to deposit the heat in very specific body regions thus providing more efficient heat treatment with less side effects. Among a variety of novel nanotechnology-based approaches with a remote, spatial and temporal control of temperature increase, magnetic hyperthermia exploits magnetic nanoparticles as heat transducers under alternating magnetic fields (AMF) that are safe for patients, with no limitations on the tissues and body penetration.
This talk aims at providing an overview of our ongoing research efforts to combine magnetic hyperthermia with other clinical accepted therapeutic modalities in particular with chemotherapy or with radiotherapy to treat solid tumors. This presentation is divided into three sections. In the first one, I will report on our progress on preparation of magnetic nanoparticles with optimal heat performance for magnetic hyperthermia.(1)(2) Our goal is to achieve the control on size, size distribution and crystallinity that in turn, enable to control the structural and magnetic properties of the magnetic nanoparticles. Moreover, progress on the synthesis and features of semiconductor-magnetic heterostructures for combining magnetic hyperthermia with radiotherapy, the latter based on cation exchange of Cu64 radioisotopes within the semiconductor domain, will be also reported. (3)
In a second part, I will report on tumor cell studies to determine the magnetic hyperthermia effects, with or without the association of chemotherapeutic drugs, on different subpopulations of patient-derived cancer cells with particular emphasis to the effects on quiescent cancer stem cells.
Finally, in a third part, I will discuss our preclinical results to evaluate the magnetic hyperthermia efficacy of some of our magnetic materials on xenograft murine tumor model focusing on bio-distributions and controlled biodegradation of magnetic nanoparticles at different compositions. (4) (5)

References

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