EuroSciCon

International Conference on
Nuclear Medicine & Radiation Therapy

October 01-02, 2018
Stockholm, Sweden

Carola Kryschi et al., J. med phys & appl sci 2018, Volume: 3
DOI: 10.21767/2574-285X-C1-001

MAGNETO-PLASMONIC NANO-HETEROSTRUCTURES AS X-RAY DOSAGE BOOSTER IN RADIATION THERAPY

Carola Kryschi and Stefanie Klein
Friedrich-Alexander University of Erlangen Nurnberg, Germany

Our primary research objective is to design magnetically targeted magneto-plasmonic nano-heterostructures (MP-NHs) that perform as multimodal nanotherapeutics for synergistic cancer therapies. Therefore superparamagnetic iron oxide nanoparticles (SPIONs) were merged with gold nanospheres, nanoclusters or nanopatches, either through a thermal decomposition procedure or via a facile co-precipitation synthesis. SPIONs with sizes around 20 nm were shown to exhibit superparamagnetism as well as to develop substantial potential as X-ray dosage enhancer when internalized by tumor cells. The Au-SPION nano-heterodimers combine high-Z material with catalytically active Fe_3O_4 surfaces and moreover, plasmonic properties with superparamagnetic performance. In case of the SPIONs, the interaction with X-rays creates through ablation highly reactive surfaces. The freely accessible Fe^{2+} and Fe^{3+} ions may efficiently catalyze in the cytoplasm with the generation of reactive oxygen species (ROS), in particular, the formation of highly reactive hydroxyl radicals (via the Fenton reaction). As boosting the ROS concentration in X-ray irradiated tumor cells for several 100%, SPIONs display a high performance as X-ray dose enhancer. For NOBF4 stabilized Au-SPION nano-heterodimers, we could verify synergistic interactions between X-radiation and both kinds of surfaces composed either of Au atoms or Fe3O4, which resulted in the simultaneous and independent formation of the nitric oxide radical at the Fe_3O_4 surface and the superoxide radical at the Au surface. The surface-confined reaction between these radicals generated peroxynitrite. This highly reactive species were observed to cause nitration of mitochondrial proteins, lipid peroxidation, and induces DNA strand breakages. As providing a synergistic nanoplatform for X-ray induced formation of both, the highly reactive radical nitric oxide, superoxide and peroxynitrite, the $NOBF_4$ functionalized Au-SPION nano-heterodimers were shown to exhibit excellent performance as X-ray enhancing agents in radiation therapy.

Biography

Carola Kryschi has completed her PhD in Physical Chemistry from Heinrich-Heine University of Duesseldorf and Postdoctoral research studies from Stanford University. In 1993, she accomplished her habilitation thesis in Experimental Physics and became an Assistant Professor of Experimental Physics at Heinrich-Heine University of Duesseldorf. Since 2000, she is University Professor of Physical Chemistry at Friedrich-Alexander University of Erlangen. She has published 2 patents and more than 100 scientific papers in peer reviewed international journals and had been serving as a Peer Reviewer for more than 30 scientific journals in Physics, Physical Chemistry, Laser Spectroscopy, Material Sciences, Biochemistry, Biophysics, Nanotechnology, Nanomedicine, Nanotoxicology and for the Volkswagenstiftung, USA; Department of Energy and Deutsche Forschungsgemeinschaft. Her current research interests are in Nanotechnology, Nanoplasmonics, Ultrafast Laser Spectroscopy, Nanomedicine and Nanooncology.

carola.kryschi@fau.de