Contribution ID: **23** Type: **not specified**

Synthesis and neutron activation of Lu2O3 nanoparticles functionalized with target specific peptides

Monday, 28 October 2019 12:00 (15 minutes)

Background
The preparation of 177Lu-peptides for targeted radionuclide therapy requires the use of lutetium-177 from medium to high specific activity (from 400 to 3000 GBq/mg), which cannot be obtained in low flux research nuclear reactors [1,2]. However, the synthesis of 176Lu in the form of injectable nanoparticles functionalized with target-specific peptides, would allow to irradiate in the TRIGA (Training, Research, Isotopes, General Atomics) Mark III reactor a mass of lutetium enough to obtain radiopharmaceuticals with activities suitable for direct medical use.
Objective
To synthesize and characterize, Lu2O3 nanoparticles functionalized with the RGD peptide, as well as to study the effect on their structural properties after neutron irradiation in the Triga Mark III reactor.
Methodology
Lu2O3 tablets were prepared and immersed in an injectable solution containing the DOTA-RGD peptide. The sample was irradiated in a Nd:YAG laser equipment (Q-Smart-100, quantel laser)(50 mJ) with a repetition rate of 10 Hz (irradiance of 16 Watts/cm2), producing instantaneously a turbid solution containing the lanthanide oxide nanoparticles with the peptide (Lu2O3-NPs-peptide) attached on their surface. The solution was purified and concentrated by ultracentrifugation and filtered through a 0.22 μm membrane (Millipore). The nanosystem was analyzed by TEM, DLS, UV-Vis and IR techniques. The Lu2O3-NPs-peptide solution (1 mg/mL), contained in a sealed vial of pharmaceutical grade plastic, was irradiated in the Triga Mark III reactor (3x1013 n.cm-2.s-1) for 20 h. After decay, the sample was reanalyzed by TEM, DLS, UV-Vis and IR techniques.
Results and discussion
TEM, DLS, UV-Vis and IR analyses of the Lu2O3-NPs-peptide sample, showed that the method of synthesis by laser irradiation (thermo-reduction) is suitable for the preparation of nanosystems based on lutetium oxide functionalized with target-specific peptides (size from 2 to 100 nm), which were not significantly affected when subjected to neutron irradiation in the Triga Mark III reactor. The irradiation of the Lu2O3-NPs-peptide (sterile solution) for 20 h, yielded 9.2 GBq useful for direct clinical use. The Lu2O3-NPs-RGD system could potentially be applied in targeted radiotherapy of intrahepatic carcinomas. In order to produce significant amounts of Lu2O3-NPs, other methods of synthesis can be applied, such as for example the thermo-reduction by calcination.
Conclusions
Laser irradiation is suitable for the synthesis of lutetium oxide nanoparticles functionalized with target-specific peptides, which are not significantly affected after neutron irradiation. The Lu2O3-NPs-RGD nanosystem is potentially useful for targeted radiotherapy purposes.
Acknowledgment
This study was supported by the Mexican National Council of Science and Technology ("Laboratorios Nacionales"and CONACyT-SEP-CB-2018, A1-S-36841).

Primary authors: Ms ANCIRA-CORTÉS, Alejandra (Instituto Nacional de Investigaciones Nucleares, Universidad Autónoma del Estado de México); Dr OCAMPO-GARCÍA, Blanca (INSTITUTO NACIONAL DE INVESTIGACIONES NUCLEARES); Dr MORALES-AVILA, Enrique (Universidad Autónoma del Estado de México); Dr LUNA-GUTIÉRREZ, Myrna (INSTITUTO NACIONAL DE INVESTIGACIONES NUCLEARES); Dr JIMÉNEZ-MANCILLA, Nallely (CONACyT. Instituto Nacional de Investigaciones Nucleares)

Presenter: Ms FERRO-FLORES, Guillermina

Session Classification: S.1