Contribution ID: **8** Type: **Submitted**

[159Dy]THCPSi production at ISOLDE for radiation theranostics together with the IS528 collaboration

Friday, 9 December 2016 09:20 (15 minutes)

The study of porous nanoparticles as drug carriers is a growing field in cancer-therapy research. The porous properties of the particle enable the anti-cancer drugs to be loaded inside the particles and the surface of the particle can be modified with targeting moieties. The nanoparticles are then injected into the bloodstream and with the penetrative capabilities of the nanoparticle the carried drugs can be targeted precisely to the tumour. This enables a high treatment efficiency together with a low strain on the surrounding tissue. Furthermore, as multiple drugs can be simultaneously loaded into the nanoparticle, a lower amount of pharmaceuticals could be needed.

Our project uses mesoporous silicon nanoparticles (PSi) which are biodegradable, and thus suitable for use in a living body [1]. As the PSi particles are loaded with drugs for cancer treatment, they can also be loaded with radionuclides. These nuclides can be used for tracing the migration of the particles inside the living body using nuclear imaging such as PET or SPECT tomography. The radionuclide implanted into the PSi particle can be chosen so that its specific radiative properties allow for both imaging and therapy at the same time [2]. Therefore, as the PSi particles reach the tumour cells, the loaded radionuclide can provide radiation treatment on a very local level.

To load the radioactivity into the PSi particles, we irradiated silicon wafers with a mesoporous THCPSi surface at ISOLDE in the spring of 2016 as part of the IS528 collaboration. The chosen radionuclide 159Dy with a half-life suitable for long in-vivo tests, was produced through proton-induced spallation of a tantalum target. The extracted ions were separated with the GPS and implanted into the silicon wafers in the GHM chamber. Close to 30 MBq of activity was obtained in four wafers, with a sufficient purity. The wafers were then post-processed into a particle distribution at the University of Helsinki, with roughly 20 MBq of total activity remaining for injection.

Prostate xenografts (5x106 PC-3MM2) were injected subcutaneously into the hip of 15 NMRI-Foxn1 nude mice. The [159Dy]THCPSi solution was then injected into the tumour. The injected activity varied between 20–150 kBq. In-vivo stability tests of the [159Dy]THCPSi particles were performed over three weeks on the tumour bearing nude mice. The activity of the tumour was measured at even time points and a biodistribution of ^{159}Dy was performed based on the harvested organs. Autoradiographic studies of histological sections of the tumours were performed with the state-of-the-art MPGD detector Le Beaver [3]. We have obtained very promising results on the stability of the [159Dy]THCPSi particles inside the tumour and we wish to present these together with our recent activities.

References

[1] H. Santos et al., Nanomedicine 9, 535 (2014)

[2] Emerging isotopes, https://www-nds.iaea.org/radionuclides/list_emerg_nuclides.htm

[3] J. Donnard et al., IEEE T. Nucl. Sci. 56, 197 (2009)

Primary author: JAKOBSSON, Ellen Helen Ulrika (Helsinki Institute of Physics (FI))

Presenter: JAKOBSSON, Ellen Helen Ulrika (Helsinki Institute of Physics (FI))

Session Classification: Medical, Bio and Solid State Physics