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FTIR study of the biochemical effects in F98 glioma cells induced by x-ray irradiations combined with nanoparticles

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Radiotherapy plays a key role in the treatment of cancer. The main limitation is to reach curative doses in the tumour while sparing the surrounding healthy tissue. One strategy to improve the clinical outcome in radiotherapy is to increase the dose effects in the tumour. This can be achieved by using specific nanoparticles (NPs). Numerous studies have shown the enhanced effectiveness of tumour control when NPs were used [1-3]. However, the involved biochemical mechanisms are not yet clear. In addition to a possible dose enhancement, the size similarity of NPs to biological molecules could provide "camouflage"to cellular barriers, leading to changes in the cellular function and producing cell arrest at radiosensitive phases or oxidative stress [4,5]. These effects, which could be amplified with a subsequent irradiation, might increase their anticancer effectiveness. Within this framework, in this study we used F98 glioma rat cells as an *in vitro* model to disentangle the biochemical changes in the cells induced by x-ray irradiations in combination with NPs. These biochemical processes can be studied by using Fourier transform infrared microspectroscopy (FTIR). FTIR allows in situ structure determination of the most important biomolecules, and it is extremely useful to study cell cycle, differentiation and proliferation of cell lines and cell death mode [6-8].

Within this context, F98 glioma cells were irradiated with x-rays in the presence and absence of Gadolinium NPs.
FTIR measurements were performed by using the internal globar source at SESAME synchrotron (Jordan). Principal Component Analysis (PCA) was performed to show the variances between two different sets of spectra. Flow cytometry and cell viability assays were also carried out.

Preliminary results are very encouraging. Figure 1 shows the PCA in the sugar and DNA region of the infrared spectra. The differences in the presence (blue) and absence (red) of Gd NPs are clearly observed for a dose of 10 Gy. PCA reveals also clear differences in the proteins and lipids regions. Biological interpretation is in progress nowadays. Forthcoming studies will consist in the evaluation of other radiotherapy approaches and other types of NPs at ALBA MIRAS beamline

References

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Caption (s) - Add figures as attached files (2 fig. max)

Figure 1. PCA in the sugar and DNA region of the infrared spectra of F98 glioma cells for a dose of 10 Gy. Blue points correspond to the presence of Gd NPs and red points to the absence of Gd NPs.

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