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Singlet oxygen generation enhancement by pectin coated silver nanoparticles for improved photosensitization efficiency in photodynamic therapy.

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The cytotoxic effect of singlet oxygen is currently used in photodynamic therapy (PDT), where the controlled production of singlet oxygen leads to the eradication of undesired tissue [1]. The inefficient production of singlet oxygen can limit the use of PDT photosensitizers, so metal-enhanced singlet oxygen generation is a desired effect.

In our study, we investigate the effect of pectin coated silver nanoparticles (Pec.AgNPs) on the photophysics of Ribolfavin (Rf) by various spectroscopic techniques.
The average size of the Pec.AgNPs was 9±2nm, measured by HR-TEM. The UV-Vis spectroscopy showed that the maximum of the plasmon absorbance is located at 414 nm. Z potential and FTIR spectroscopy, confirm the effective coating of the nanoparticles by pectin.
Using UV-Vis spectroscopy, we proved the formation of a complex between Rf and Pec.AgNPs.
Laser flash-photolysis assays with Rf with and without Pec.AgNPs showed that when the particles are present the triplet state of Rf is formed at shorter times and that there is an enhancement of its population. As a consequence of this enhancement, we also observed increased amounts of reactive oxygen species.
Hela cells were incubated with the Rf, with and without the Pec.AgNPs and irradiated at 350 nm. Cell viability MTT and Neutral Red assays showed an increased cell death in the presence of the particles.

Here I want to employ the synchrotron infrared microscopy to detect the associated intracellular biochemical modifications following the visible light irradiation of HeLa cells incubated with Rf and Pec.AgNPs. The single cell IR spectra of PDT-treated with Rf, Rf+Pec.AgNPs, and Rf+Pec.AgNPs+epicatechin (singlet oxygen quencher) and control samples will be recorded using the SOLEIL Synchrotron Infrared SMIS beamline targeting specifically the cell nucleus. The Amide I and Amide II vibrational bands will be analysed searching for changes in the protein secondary structures of the PDT-treated cancer cells under different conditions.

[1]Bonnett, Chemical Aspects of Photodynamic Therapy; Gordon and Breach Science Publishers: Amsterdam, 2000.