**Biophotonics for the characterization of liposomes for Glioblastoma and Alzheimer's Disease treatment**

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An accurate characterization of liposome-based formulations (LPs) is a key requisite to have a comprehensive overview of the physical, chemical, and biological features. Hence, in this study we proposed Surface Plasmon Resonance Imaging (SPRi) and Raman Spectroscopy (RS) as innovative tools for the validation of dual-functionalized LPs for the treatment of Glioblastoma and Alzheimer's Disease. Drug-loaded LPs were functionalized with mApoE to cross the blood-brain barrier and with a protease sensitive peptide to guarantee a localized release of the candidate drugs. SPRi analysis was performed in order to evaluate the binding affinity and kinetics of the LPs to their target receptors, whereas RS was used as quality control platform for the synthesis. SPRi results confirmed not only the presence of mApoE on LP surfaces, but also its different binding affinity to receptors. Instead, the Raman fingerprints revealed a good level of reproducibility of the formulations and allowed to statistically discriminate LPs with different functionalization patterns, showing that each molecular component has an influence in the Raman spectrum of the final LPs. In conclusion, our results demonstrated the ability of the proposed biophotonics-based tools to evaluate the binding affinity of mApoE once incorporated in LPs and to study the LP chemical composition in a label-free, economic and fast manner.