Physicochemical analysis of size-dependent gold nanoparticles for biomedical development

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Gold nanoparticles (AuNPs) represent a group of noble metals developed in various scientific fields such as catalysis, cancer treatment, or bio-imagining. They are considered highly stable, biocompatible, and able to surface functionalization. But most of all, AuNPs are governed by optical properties, through localized surface plasmon resonance (LSPR), described as collective electron oscillations excited by the interaction between electromagnetic field and incident light [1]. According to scientific reports, LSPR is strictly related to the geometrical features of the gold nanoparticles [2,3]. The ability to tune the plasmon resonance may impact future applications in biomedical nanomaterials, for instance, therapeutic agents or drug delivery systems.

In this work, gold nanoparticles were synthesized using a modification of the Turkevich-based method and were regulated in size from 8 nm to 20 nm. The chemical conditions were controlled based on pH level. Morphology and size distribution was analysed by Transmission Electron Microscopy (TEM), whereas electronic structure was determined by X-ray Absorption Spectroscopy (XAS). In order to indicate the difference in LSPR resonance, UV-VIS spectroscopy measurement was performed.

The preliminary results showed that the synthesis as such leads to small-size and sphere-shaped colloidal nanoparticles. Based on XAS spectra, visible changes were found in the EXAFS area as the size of the nanoparticles increased. The plasmon resonance was observed for the wavelength range corresponding to each nanoparticle size.

The difference in AuNPs sizes displayed a strong correlation between physical and chemical properties. Therefore, it could give more information needed to design NPs hybrid systems involving functionalizing them with proteins or enzymes.

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References

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