Confocal Imaging of Label-Free Nanoparticles in Cells and Biological Tissues

Muriel F. Gusta1
Lena Montaña2, Oscar H. Moriones1, Neus G. Bastus1, Victor F. Puntes1,2,3

1. Institut Catala de Nanociencia i Nanotecnologia, Campus de la UAB, 08193 Barcelona, Spain
2. Vall d'Hebron Institut de Recerca, Pg de la Vall d'Hebron 119-129, 08035 Barcelona, Spain
3. Institut Catala de Recerca i d'Estudis Avançats, Pg Lluís Companys 23, 08010 Barcelona, Spain

muriel.freixanet@icn2.cat

Noble metal nanoparticles (NPs), particularly gold (Au) and silver (Ag) NPs, have recognized relevance in chemistry, physics, and biology because of their outstanding optical, electrical, and photothermal properties. Optical properties, as localized surface plasmon resonance, are easily measurable signatures indicative of their morphology (size and shape), composition, surface chemistry, aggregation state and physical environment that can be used to identify molecular targets and chemical transformation processes. [1] Due to the growing interest in the use of metal NPs in medicine and biology, detailed cellular studies are required before their application in vivo for treatment or diagnostic purposes. [2] Herein, we present the observation of unlabelled Au NPs on Confocal Laser Scanning Microscopy (CLSM), by using the light reflectance instead of the commonly used fluorescence mode. The NPs size resolution limits for CLSM observation is studied experimentally. Theoretical calculations, of the size-dependent optical properties are also presented to support this argument. The Au NPs used were synthesized using the seeded growth citrate reduction method [3], and the NPs sizes range from 15nm to 150nm. Full characterization of the produced NPs was also performed by Transmission Electron Microscopy (TEM), UV-Vis spectroscopy and Dynamic Light Scattering (DLS). Further, the intracellular observation of different sizes of Au NPs using the reflectance mode is also presented in cultured cells and tissue sections. This work reveals as a method to observe NPs in living systems in real-time and non-invasive way, which can be extended to other inorganic

References

[1] 1] Piella, J.; Bastús, N. G.; Puntes, V., Zeitschrift für Phys. Chemie, 231, (2017) 33–50
[2] [2] García-Fernández, L.; Garcia-Pardo, J.; Tort, O.; Prior, I.; Brust, M.; Casals, E.; Lorenzo, J.; Puntes, V. F. Nanoscale, 9 (2017) 6111–6121
[3] [3] Bastús, N. G.; Comenge, J.; Puntes, V. Langmuir, 27 (2011) 11098–11105