

# Nanooptics and photonics

## Effect of photoactivation of amino acid tryptophan on gold nanoparticles formation

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The tryptophan/Au system is a promising base for design of hybrid biocompatible gold nanoparticles (Au NPs) and their further implementation in cancer diagnostics and therapy. The physical and chemical properties of such objects depend on the size of Au NPs. However the size-controllable synthesis of Au NPs in the presence of amino acid tryptophan is still unclear and remains the challenge. We assume that morphology of obtained Au NPs can be controlled by two ways: chemical (e.g., varying concentration and pH) and photochemical (e.g., varying wavelength, power density and time of UV light illumination).

In this work, the mechanism of photoinduced conversion of amino acid tryptophan while interacting with Au<sup>3+</sup> ions and further formation of Au NPs were investigated by UV/vis absorption spectroscopy and mass spectrometry. We found that the reaction in the tryptophan/Au system proceeds in two stages. The first one refers to the reduction of Au<sup>3+</sup> ions by amino acid tryptophan that leads to formation of metal “primary clusters”. The second stage is characterized by further accumulation of Au NPs from previously formed clusters that was observed by the growth of localized surface plasmon resonance (LSPR) band of gold in absorption spectra. The intensity of LSPR band in its maximum at 560 nm increased in 1.5 times faster when the concentration of amino acid used in the synthesis was increased (from 1:1 to 2:1 molar excess compare to metal), that affected on processes of nucleation and growth of NPs. At the same time the similar trend was observed when UV light illumination at 280 nm (1±0.2 mW/cm<sup>2</sup>, UVC LED, LGInnotek) was used to activate the photochemical reaction between tryptophan and Au<sup>3+</sup> at equal molar amount (1:1). The transformation of tryptophan via kynurenine pathway was confirmed by UV-vis and mass spectra.

Thus, in the tryptophan/Au system we can influence on the gold nanoparticles formation and their further growth chemically, by changing the amount of reducing agent, as well as photochemically, by using UV light illumination.