In situ synthesis of short-chain thiols silver nanoparticles (STSNs) for biological purposes: from silver toxicity to tumors treatment. An overview.

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Abstract

A novel method for the *in situ* synthesis of many different short-chain thiols functionalized silver nanoparticles that offer a decorated surface with different organic groups, like amine or carboxilic groups, has been developed. These nanoparticles possess suitable biological properties and the ability to bind different types of biomolecules like cytostatics, antibodies or DNA.

The optical properties of the localized surface plasmon resonances (LSPRS) of metal nanoparticles, like gold and silver, offer exceptional characteristics for the next era of medicine. Theranostic is the field of emerging technology occupied in the development of new systems for both diagnostic and treatment of several pathologies. These plasmonic nanosystems allow targeted delivery of molecules and their monitoring through different optical imaging techniques. On the other hand, the SERS and SEIRAS effect of these nanosystems may be suitable for biosensing methods in order to determinate the presence of metabolites, proteins, oligonucleotides sequences or pollutants faster and with increased sensitivity compared to that of conventional techniques [1].

The organic capping agents studied were 4,6-Diamino-2-mercaptopyridine, mercaptoacetic acid and cysteamine, being the last one of paramount interest due to its biomedical properties and physical-chemistry skills, as well as its positive charge at physiological pH. These characteristics make cysteamine an exceptional candidate for interaction essays with DNA/RNA sequences.

Many studies relate toxicity of silver nanoparticles with ROS generation and apoptosis via the mitochondrial pathway [2]. The threshold resistance to oxidative stress is higher in healthy cells than it is in tumor cells. Thus, we propose the use of these thiol-functionalized silver nanoparticles as adjuvants in cancer disease and as drug vector systems [3]. We assessed the capability of these nanoparticles for siRNA delivery by conjugating siRNA targeting Bcl-2 protein, implicated in the resistance of many tumors.

References

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Figures

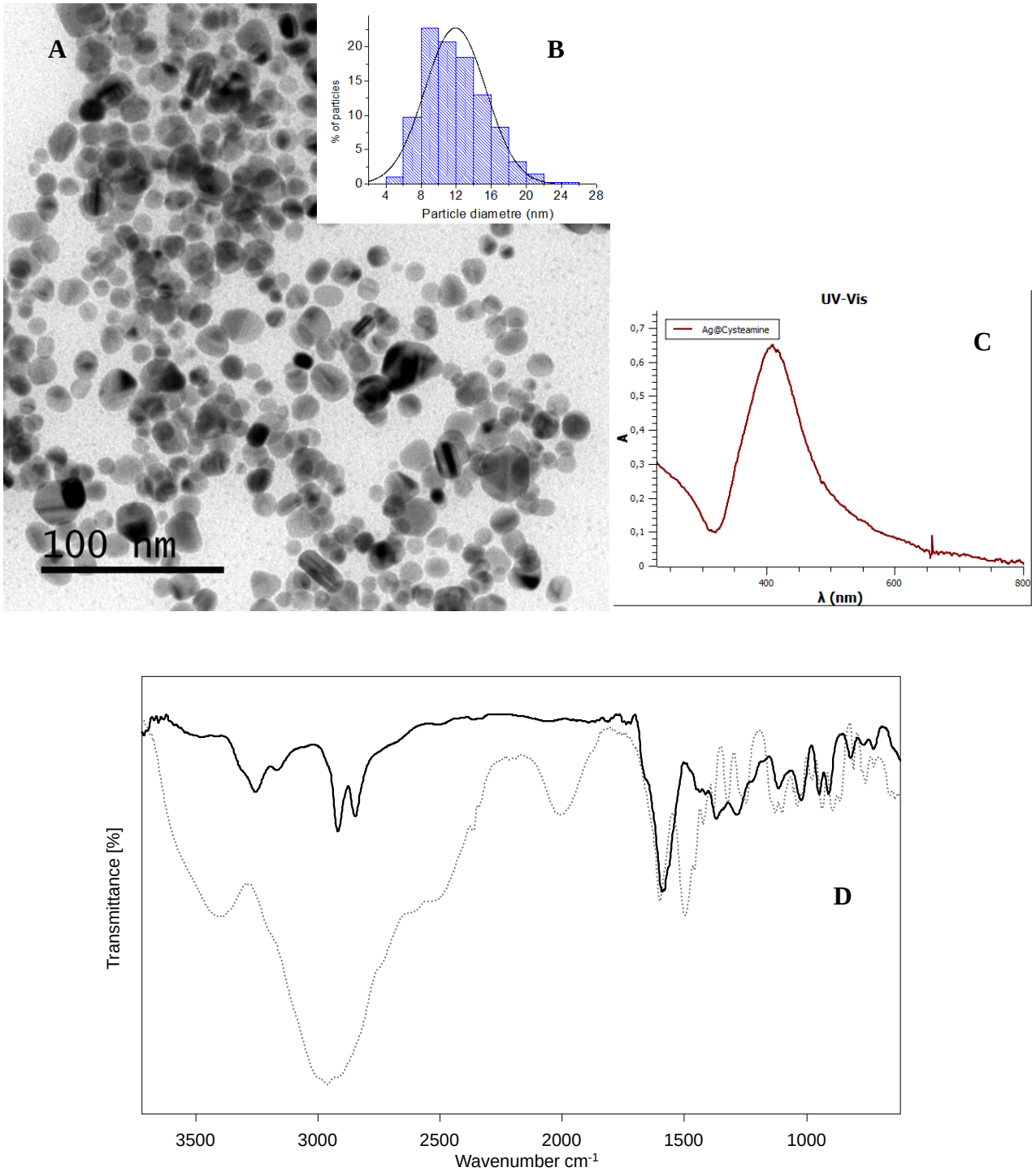

Figure. Cysteamine silver nanoparticles. (A) TEM, (B) size distribution, (C) UV-Vis spectrum, (D) FT-IR spectra, dotted line cysteamine, solid line cysteamine silver nanoparticles.