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The role of tannic acid and sodium citrate in the synthesis of silver nanoparticles for biomedical applications

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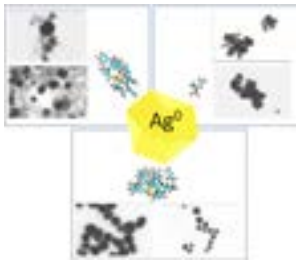
We describe herein the significance of a sodium citrate and tannic acid mixture in the synthesis of spherical silver nanoparticles (AgNPs). Monodisperse AgNPs were synthesized via reduction of silver nitrate using a mixture of two chemical agents: sodium citrate and tannic acid. The shape, size and size distribution of silver particles were determined by UV–Vis spectroscopy, Dynamic Light Scattering (DLS) and Scanning Transmission Electron Microscopy (STEM). Special attention is given to understanding and experimentally confirming the exact role of the reagents (sodium citrate and tannic acid present in the reaction mixture) in AgNP synthesis. The oxidation and reduction potentials of silver, tannic acid and sodium citrate in their mixtures were determined using cyclic voltammetry. Possible structures of tannic acid and its adducts with citric acid were investigated in aqueous solution by performing computer simulations in conjunction with the semiempirical PM7 method. The lowest energy structures found from the preliminary conformational search are shown, and the strength of the interaction between the two molecules was calculated. The compounds present on the surface of the AgNPs were identified using FT-IR spectroscopy, and the results are compared with the IR spectrum of tannic acid theoretically calculated using PM6 and PM7 methods. The obtained results clearly indicate that the combined use of sodium citrate and tannic acid produces monodisperse spherical AgNPs, as it allows control of the nucleation, growth and stabilization of the synthesis process.



Biography

Grzegorz Celichowski is a Faculty Member in the Department of Materials Technology and Chemistry and involved in nanoparticles synthesis, characterisation and modification, especially for biomedical applications. His personal specialization is focused on methods of chemical synthesis and functionalization of metallic nanostructures and their characterization by spectroscopic methods. In addition to nanoparticles, he is also interested in synthesis and application of silver nanowires as textile materials modifiers for obtaining biologically and electricity active multifunctional materials.

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