Journal of Inorganic Biochemistry 204 (2020) 110958

Contents lists available at ScienceDirect

Journal of Inorganic Biochemistry

journal homepage: www.elsevier.com/locate/jinorgbio

Green synthesis and characterization of nontoxic L-methionine capped silver and gold nanoparticles

B. Laban[a], U. Ralević[b], S. Petrović[c], A. Leskovac[c], D. Vasić-Anićijević[c], M. Marković[c], V. Vasić[c,*]

[a] Faculty of Sciences, University in Priština – Kosovska Mitrovica, Lole Ribara 29, 38220 Kosovska Mitrovica, Serbia
[b] Center for Solid State Physics and New Materials, Institute of Physics, University of Belgrade, Pregrevica 118, 11080 Belgrade, Serbia
[c] Vinča Institute of Nuclear Sciences, University of Belgrade, P.O. Box 522, Belgrade, Serbia

ARTICLE INFO

Keywords:
Silver
Gold
Green
Nanoparticles
L-methionine
Toxicity

ABSTRACT

The simple green method for synthesis of stable L-Methionine (L-Met) capped silver (Ag@LM NPs) and gold (Au@LM NPs) nanoparticles (NPs) without adding any additional reduction agent or stabilizer was developed. Colloidal dispersions were characterized by UV–Vis spectrophotometry. The size and spherical shape of NPs were evaluated by transmission electron microscopy. Their surface covering was confirmed by atomic force microscopy, Fourier transform infrared spectroscopy, dynamic light scattering, and zeta potential measurements. Density functional theory calculations pointed that the preferential adsorption mode of L-Met on both Ag and Au surfaces was a vertical binding geometry via $–NH_2$ group, while horizontal binding mode via $-S-$ and $–NH_2$ groups is also possible. The genotoxicity (evaluated by the micronucleus assay) of NPs, as well as their effects on some oxidative stress parameters (catalase activity, malondialdehyde level), were assessed in vitro using human peripheral blood cells as a model system. The influence of NPs on the morphology of lymphocyte cells studied using atomic force microscopy revealed that the membrane of cells remained unaffected after the treatment with NPs. When considering the effects of NPs on catalase activity and malondialdehyde level, neither particle type promoted oxidative stress. However, the treatment of lymphocytes with Ag@LM NPs induced a concentration-dependent enhancement of the micronuclei incidence and suppression of the cell proliferation while Au@LM NPs promoted cell proliferation, with no significant effects on micronuclei formation. The Ag@LM NPs were more prone to induce DNA damage than Au@LM NPs, which makes the latter type more suitable for further studies in nano-medicine.

* Corresponding author.
E-mail address: evasic@vinca.rs (V. Vasić).

https://doi.org/10.1016/j.jinorgbio.2019.110958
Received 16 August 2019; Received in revised form 3 December 2019; Accepted 8 December 2019
Available online 11 December 2019
0162-0134/