PROTEIN CROSSLINKING ONTO GOLD NANOPARTICLES BY GAMMA RADIATION

Gustavo H.C. Varca[*1], Janaína A.G. Barros[1], Jorge G.S. Batista[1], Rafaela Sasounian[2], Gustavo T.M. Silva[2], Vitor M. Zamarion[2], Kattesh V. Katti[3], Ademar B. Lugão[1]

[1]Instituto de Pesquisas Energéticas e Nucleares (IPEN-CNEN/SP), Av. Lineu Prestes 2242, 05508-000, São Paulo, Brazil.
[2]Instituto de Química, Universidade de São Paulo, Avenida Lineu Prestes 748, 05508-000, São Paulo, Brazil.
[3]University of Missoury, 223 Physics Bldg., 65211-7010, Columbia, United States.

Keywords: Gold nanoparticles, Protein Crosslinking, Ionizing Radiation, Bovine Serum Albumin.

ABSTRACT

The use of gold nanoparticles for diagnosis and treatment of cancer has received great attention over the last decade. Particularly, the possibility to use them for theranostics has increased the interest in the medical and scientific community. Weak technological aspects are related to the low biological affinity and non-specific toxicity. The use of albumin is of highlighted interest as albumin has been associated to inorganic particles to overcome biopharmaceutical challenges, including site-specific delivery and other biopharmaceutical advantages. The current work addresses the use of radiation and its effects over the crosslinking of bovine serum albumin onto gold nanoparticles. The idea of crosslinking the albumin onto gold surface aims to improve the stability of the protein layer onto gold nanoparticles in biological systems. Gold nanoparticles were synthesized by green technology using resveratrol and albumin capping was performed by physiosorption followed by irradiation at doses of 2.5, 5, 7.5, 10 and 15 kGy using ^{60}Co as a radioactive source. Nanoparticle properties were assessed by dynamic light scattering, UV/Vis spectrophotometry and transmission electron microscopy. Protein crosslinking was monitored by fluorescence studies and stability of the nanoparticles was evaluated by zeta potential and titration with sodium chloride. The results evidenced the formation of a protein layer onto gold nanoparticles and revealed a protein crosslinking by means of bityrosine as a function of irradiation dose. Stability was considerably improved by the presence of the protein layer and the crosslinked protein layer.

[*] corresponding author: varca@usp.br