Proceedings of the World Congress on Recent Advances in Nanotechnology (RAN'16)
Prague, Czech Republic – April 1 – 2, 2016
Paper No. NDDTE 115
DOI: 10.11159/nddte16.115

Synthesis and Characterization of Curcumin Gold Nanoparticles: Sonosensitizer Agent for Atherosclerosis

Teixeira Bruna Henrique[1], Chaves Alisson Alencar[2], Batista Wagner Luis[2], Courrol Lilia Coronato[1]
[1]Universidade Federal de São Paulo, Laboratório de Lasers e Óptica Biomédica Aplicada, Departamento de Ciências Exatas e da Terra, Diadema, SP – Brazil
[2]Universidade Federal de São Paulo, Bioquímica de Fungos e Protozoários, Departamento de Ciências Biológicas, Diadema, SP – Brazil
lccourrol@gmail.com

Extended Abstract

Atherosclerosis is a chronic inflammatory disease and the primary cause of human death worldwide[1]. Some studies have suggested that macrophages play a critical role in the development, progression, and destabilization of atherosclerotic plaques[2]. Thus, the reduction of macrophages from plaques represents a new strategy for the treatment of atherosclerosis[3]. Sonodynamic therapy (SDT) is emerging as a new atherosclerosis treatment[4] due to the generation of free radicals by activated sonosensitizers, which can lead to apoptotic cell death. The use of gold nanoparticles (AuNPs) as the vehicle for a sensitizer delivery improves reactive oxygen species formation [5].

Curcumin (Curc), a polyphenol derived from the *Curcuma Longa* plant, presents a sonodynamic effect on THP-1 derived macrophages [3]. The aim of this present study is to evaluate the effects of SDT on the viability of THP-1 macrophages incubated with Curc:AuNPs.

To prepare Curcumin Gold Nanoparticles (Curc:AuNps) solutions, 3.2 mg of chloroauric acid was mixed with 1.5 mg of Curcumin and Polyethylene glycol (PEG) in Mili-Q water. The synthesized nanoparticles were characterized by UV/Vis optical absorption, and electron microscopy. THP-1 macrophages were incubated with Curc and Curc:AuNPs for 2 hours and then exposed to pulsed ultrasound irradiation (2 W/cm^2 with 1.0 MHz) for 5, 10 and 15 min. The survival rate of the cells was measured by MTT assay. All quantitative results were obtained from at least triplicate samples.

The successful synthesis of the Curc:AuNps was indicated by the presence of a surface plasmon resonance at ~520 nm, characteristic of spherical gold nanoparticles. TEM analyses showed ~17±2 nm nanoparticles.

The Curc:AuNPs SDT decreased cell viability more significantly than the treatment with ultrasound alone, mainly in cells treated for 15 min. Treatment with curcumin alone did not affect the cell viability when compared to control. The findings suggested that Curc:AuNps under low-intensity ultrasound has sonodynamic effect on THP-1 macrophages via generation of intracellular singlet oxygen and photothermic effect, indicating that Curc:AuNps can be used as a novel sonosensitizer in SDT for atherosclerosis.

This work was supported by the "Fundação de Amparo à Pesquisa do Estado de São Paulo" (FAPESP), Grant number 2014/06960-9.

References

[1] V. N. Borshch, E. R. Andreeva, S. G. Kuz'min, *et al.*, "New medicines and approaches to treatment of atherosclerosis," *Russian Journal of General Chemistry,* vol. 82, no. 3, pp. 554-563, 2012.
[2] J. L. Cheng, X. Sun, S. Y. Guo, *et al.*, "Effects of 5-aminolevulinic acid-mediated sonodynamic therapy on macrophages," *International Journal of Nanomedicine,* vol. 8, pp. 669-676, 2013.
[3] F. P. Wang, Q. P. Gao, S. Y. Guo, *et al.*, "The Sonodynamic Effect of Curcumin on THP-1 Cell-Derived Macrophages," *Biomed Research International*, 2013.
[4] S. Y. Guo, X. Sun, J. L. Cheng, *et al.*, "Apoptosis of THP-1 macrophages induced by protoporphyrin IX-mediated sonodynamic therapy," *International Journal of Nanomedicine,* vol. 8, pp. 2239-2246, 2013.
[5] M. Benito, V. Martin, M. D. Blanco, *et al.*, "Cooperative effect of 5-aminolevulinic acid and gold nanoparticles for photodynamic therapy of cancer," *Journal of Pharmaceutical Sciences,* vol. 102, no. 8, pp. 2760-2769, 2013.