DEVELOPMENT OF RADIATION-INDUCED ALBUMIN-BASED NANOPARTICLES

Cássia Priscila Cunha da Cruz [1*], Daniel Temponi Lebre [1], Larissa Sabino dos Santos [1,] Ademar Benévolo Lugão [1]

[1] CEQMA/Instituto de Pesquisas Energéticas e Nucleares (IPEN-CNEN)/ Universidade de São Paulo, Brazil

* Corresponding author: cassia.cruz@usp.br

Keywords: Albumin; Nanoparticles; Melatonin; Nanocarriers.

Introduction and objective: Proteins have been the subject of studies in nanotechnology because they have properties such as high biocompatibility and low toxicity. In this work, we emphasize albumin for the development of nanostructured systems developed by radiation-induced cross-linking [1], intending to deliver melatonin for antitumor purposes, as well as determining its morphological, physicochemical characteristics and evaluating the profile on normal and tumor cells. The development of the study is significant, as new strategies based on nanoparticles make it possible to combat existing challenges in conventional therapy in the treatment of cancer, along with improvements in targeting drugs in the tumor.

Methodology: The synthesis was carried out in the presence of ethanol (30%, v/v) and variation in protein concentration from 0.5 to 10mg/mL in different buffers (phosphate and tris-HCl), both at a concentration of 50mM and gamma radiation (1-20 kGy) for nanoparticle formation. The samples were evaluated using the dynamic light scattering technique assess the hydrodynamic diameter, infrared spectroscopy, and fluorescence. The encapsulation efficiency was made by high-performance liquid chromatography, and the cytotoxicity of the nanoparticles was evaluated for the proliferation in different tumor cells.

Results and discussion: In this work, albumin nanoparticles were developed containing melatonin, aiming for better melatonin availability related to the free drug. The use of radiation for cross-linking of nanoparticles has advantages since it is not restricted to the lack of monomers in the process, and, additionally, the absence of cross-linking agents ensures low residual toxicity and reduces possible purification steps of remaining monomers. Through the characterization analysis of the nanoparticles, it was possible to observe that the average diameter obtained varies from 30-60nm. It was possible to analyze that the increase in the size of the nanoparticles is directly linked to the change of buffer, albumin concentration, and irradiation dose, the average encapsulation efficiency was above 50%, the nanoparticles remained stable for at least 60 days, both at room temperature and in a refrigerated environment. The analyzed nanoparticles did not demonstrate a cytotoxicity profile in healthy cells.

Conclusions: The development protocol of the nanostructured system presented nanoparticles with desirable sizes and stability in the time studied and also observed the efficiency of incorporation of the drug in the nanoparticles, demonstrating promising nanocarriers for the loading of radiopharmaceuticals and physicochemical compatible with the nanostructured systems for application biological.

References

1. Queiroz, r. G. *et al*. International Journal of Biological Macromolecules, 85, 82–91, 016.

Acknowledgments

This study was financed in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior – Brasil (CAPES) – Finance Code 001 and the Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP) (2017/50332-0)