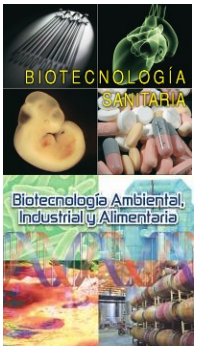
Poster



Synthesis, characterization and in vitro evaluation of doxorubicin and tannic acid nanoparticles

Garzo-Sánchez, Olga (1,2,*); Colino Palomino, Ana M (2); Maisanaba, Sara (2); Merkling, Patrick J (1); Llana Ruiz, Maria (2); Repetto, Guillermo (2); Zaderenko Partida, Ana Paula (1)

(1) Área de Química Física. Departamento de Sistemas Físicos, Químicos y Naturales. Facultad de Ciencias Experimentales. Universidad Pablo de Olavide, 41013 Sevilla, España.

(2) Área de Toxicología. Departamento de Biología Molecular e Ingeniería Bioquímica. Facultad de Ciancias Experimentales. Universidad Pablo de Olavide, 41013 Sevilla, España.

Tutor académico: Zaderenko Partida, Ana Paula; Maisanaba Hernández, Sara.

Keywords: nanoparticles; doxorubicin; tannic acid.

ABSTRACT

Breast cancer is one of the most common and deadly neoplasms in women worldwide. However, treatment with doxorubicin, a widely used chemotherapeutic agent for this disease, is limited by its high toxicity and systemic side effects. Therefore, new therapeutic strategies, such as the use of nanoparticles, have been explored with the potential to enhance treatment efficacy and reduce toxicity [1]. In this context, the main objective of this work has been the synthesis and characterization of doxorubicin nanoparticles coated with tannic acid. The latter was chosen as a coating due to its various beneficial biological activities, such as its antitumoral properties, which are related to the expression of the epidermal growth factor receptor (EGFR). Tannic acid can enhance the effectiveness of chemotherapy and also reduce its toxicity through numerous mechanisms, including anti-inflammatory and antioxidant activities, among others [2]. Additionally, the antitumoral efficiency of these nanoparticles is being evaluated both in silico and in vitro in cell cultures showing different EGFR expression, aiming to explore their potential application in anticancer therapies.

Methods: Tannic acid-coated doxorubicin nanoparticles (TADOX) were synthesized according to a method developed by our group [3]. The process was modified to ensure the proper formation of stable nanoparticles with the desired size. Subsequently, TADOX nanoparticles were characterized by techniques such as Dynamic Light Scattering (DLS), Ultraviolet-Visible spectroscopy (UV-Vis) and Fourier Transform Infrared Spectroscopy (FTIR). Additionally, cytotoxicity assays of the nanoparticles were conducted on breast cancer cell lines and Molecular Docking (MD) calculations were performed using autodock Vina 1.2.5.

Results and conclusions: We have managed to obtain TADOX nanoparticles whose stability, surface charge, hydrodynamic diameter and polydispersity index make them suitable for use in biomedical applications. Thus, according to their characteristics, TADOX are suitable for passive targeting and tissue penetration. Their composition was validated by UV-Vis and FTIR, and their stability was confirmed by zeta potential measurements. Breast cancer tumor cells have shown different sensitivity to our nanoparticles depending on their genetical profile. MD calculations were used to get a picture on the microscopic scale.

REFERENCES

[1] Shafei A, El-Bakly W, Sobhy A, Wagdy O, Reda A, Aboelenin O, Marzouk A, El Habak K, Mostafa R, Ali MA, Ellithy M. A review on the efficacy and toxicity of different doxorubicin nanoparticles for targeted therapy in metastatic breast cancer. Biomed Pharmacother. 2017 Nov;95:1209-1218. doi: 10.1016/j.biopha.2017.09.059. Epub 2017 Sep 18. PMID: 28931213.

[2] Ghasemian M, Kazeminava F, Naseri A, Mohebzadeh S, Abbaszadeh M, Kafil HS, Ahmadian Z. Recent progress in tannic acid based approaches as a natural polyphenolic biomaterial for cancer therapy: A review. Biomed Pharmacother. 2023 Oct;166:115328. doi: 10.1016/j.biopha.2023.115328. Epub 2023 Aug 15. PMID: 37591125.

[3] Aguilera, J.R., Venegas, V., Oliva, J.M., Sayagués de Vega, M.J., de Miguel, M., Sánchez-Alcazar, J.A. y Zaderenko Partida, A-P. (2016). Targeted multifunctional tannic acid nanoparticles. RSC Advances, 6 (9), 7279-7287.