Back

ORIGINAL ARTICLE

Carboplatin-loaded zeolitic imidazolate framework-8: Induction of antiproliferative activity and apoptosis in breast cancer cell

Saravanan Ganapathy, Muruganantham Bharathi, Abdurahman Hajinur Hirad, Abdullah A. Alarfaj, Indumathi Thangavelu, Palanisamy Arulselvan, Ravindran Jaganathan **... See all authors**

First published: 03 November 2024

https://doi.org/10.1002/bab.2689

Abstract

The challenge with breast cancer is its ongoing high prevalence and difficulties in early detection and access to effective care. A solution lies in creating tailored metal–organic frameworks to encapsulate anticancer drugs, enabling precise and targeted treatment with less adverse effects and improved effectiveness. Zeolitic imidazolate framework-8 (ZIF-8) and carboplatin (CP)-loaded ZIF-8 were synthesized and characterized using various analytical techniques. High Resolution-transmission electron microscopy of ZIF-8 and CP@ZIF-8 indicates that the particles had a spherical shape and were nanosized. The drug release rate of CP is 98% under an acidic medium (pH 5.5) because of the dissolution of ZIF-8 into its coordinating ions, whereas 35% in a physiological medium (pH 7.4) with the addition of CP, the high porosity, and pore diameter of ZIF-8 decrease from 1243 to 1041 m^2/g. Breast cancer MCF-7 cells were shown greater IC_{50} in CP@ZIF-8 (15.01 ± 3.03 μg/mL) than free CP (34.98 ± 4.25 μg/mL) in an in vitro cytotoxicity assessment. The cytotoxicity of the CP@ZIF-8 against MCF-7 cells was studied using the methylthiazolyldiphenyl-tetrazolium bromide method. The morphological changes were examined using fluorescent staining (acridine orange–ethidium bromide and Hoechst 33258) methods. The comet assay assessed the DNA fragmentation (single-cell gel electrophoresis). The results from the study revealed that CP@ZIF-8 can be used in the treatment of breast cancer.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT