



Research article

Impacts of designed vanillic acid-polymer-magnetic iron oxide nanocomposite on breast cancer cells

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ABSTRACT

The engineered nano-vehicle was constructed using magnetic iron oxide nanoparticles (MIONs) and chitosan (CTS) to stabilize anticancer agent vanillic acid (VNA) which was loaded on CTS-coated MIONs nanocarrier, and more importantly, to achieve sustained VNA release and subsequent proper anticancer activity. The new thermally stable VNA-CTS- MIONs nanocomposite was spherical with a middle diameter of 6 nm and had a high drug loading of about 11.8 %. The MIONs and resulting nanocomposite were composed of pure magnetite and therefore, were superparamagnetic with saturation magnetizations of 53.3 and 45.7 emu.g⁻¹, respectively. The release profiles of VNA from VNA-CTS-MIONs nanocomposite in different pH values were sustained and showed controlled pH-responsive delivery of the loaded VNA with 89 % and 74 % percentage release within 2354 and 4046 min at pH 5 and 7.4, respectively, as well as were in accordance with the pseudo-second-order model. The VNA-CTS-MIONs nanocomposite treatment at diverse concentrations remarkably decreased the viability and promoted ROS accumulation and apoptosis in the MDA-MB-231 breast cancer cells. Hence, it can be a propitious candidate for the management of breast cancer in the future.

1. Introduction

Breast cancer, the most common malignancy in women, had a major impact on the patient's physical and mental health. It was the prime reason for cancer death amid women around the globe [1]. Breast cancer treatment options included surgical removal of the tumor, chemotherapy, radiation, and hormone therapy. Despite the availability of many chemotherapeutic medications, the capability of cancerous cells to gain resistance toward these drugs posed a significant problem for cancer treatment [2]. Additionally, the tumor

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