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Short communication

Tannic acid chitosan iron oxide nanocomposite for cervical cancer treatment

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Highlights

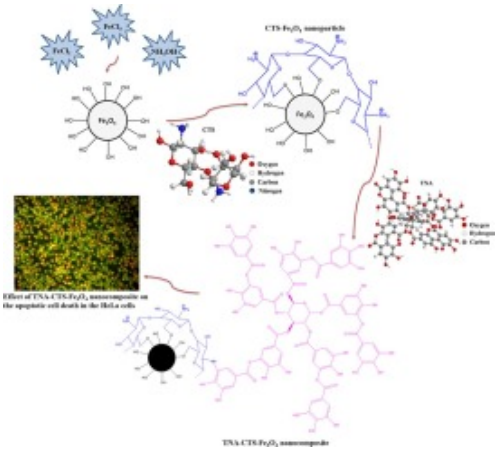
- A novel anticancer nanodrug, tannic acid-polymer-iron oxide was constructed.
- The superparamagnetic nanocomposite had a mean size of 9nm with controlled release feature.
- The nanocomposite treatment remarkably inhibited cell growth in the cervical cancer HeLa cells.
- This nanocomposite can be a potential anticancer agent for the treatment of cervical cancer.

Abstract

An innocuous and stimuli-responsive nano-vehicle was constructed from chitosan (CTS) and synthesized iron oxide (Fe_3O_4) nanoparticles. Tannic acid (TNA) was selected as a drug model to attest to the function of CTS-Fe_3O_4 nano-vehicle in cervical cancer therapy. Fourier transform infrared (FTIR) data disclosed that Fe_3O_4 nanoparticles could be favourably coated with CTS and TNA in thermally stable and superparamagnetic TNA-CTS-Fe_3O_4 nanocomposite (saturation

magnetization of 41.1 emu/g) while the CTS-Fe_3O_4 nano-vehicle afforded a perfect microenvironment for efficient loading (10.5%) and controlled release of TNA. Intriguingly, in vitro release profiles for TNA-CTS-Fe_3O_4 nanocomposite at pH 5 and 7.4 were governed properly with a pseudo-second-order kinetic model and the pH value influenced the TNA release profiles with a cumulative release percentage of 90% within 1892 min at a pH of 5 and 79% within 3915 min at a pH of 7.4. What is more, the treatment with TNA-CTS-Fe_3O_4 nanocomposite with a mean diameter of 9 nm, substantially reduced the cell growth and induced apoptosis in the cervical cancer HeLa cells. Therefore, it was verified that the TNA-CTS-Fe_3O_4 nanocomposite could be a potential anticancer agent for the treatment of cervical cancer with distinctive physicochemical features.

Graphical abstract



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Introduction

Cervical cancer ranked as the fourth most common cancer type in developed nations, and second most common cancer diagnosed in developing nations after breast cancer. It is the third most common cause of cancer-related mortalities followed by breast and lung cancers. Several methods, including surgery, radiation therapy, and chemotherapy, have been developed to treat cervical cancer and these current conventional treatments had considerable problems, including limited efficacy and substantial toxicity. [1], [2]

Given the width of the inherent disfavours of conventional cancer cures, the advancement of cancer nanotechnology has been propelled forward in current periods for attaining amended therapeutic outcomes. The key progress was the optimization of the biological fate of anticancer drugs via robust drug delivery strategies like nanostructured systems which could assist to gain the full merits of the path by the feasibility of enhancing targeting and selectivity, lowering cytotoxicity, declining the prevalence of administration, and elongating tissue retention. [3], [4], [5] Polymeric nanoparticles combining diagnostic imaging and therapeutic delivery have emerged as a powerful solution for future cancer therapy. These nanoparticles can be used in site-specific drug delivery to enhance the uptake of anticancer drugs and target cancer cells. [6], [7], [8], [9], [10]