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Concanavaline a Conjugated Bacterial Polyester Based PHBHHx Nanoparticles Loaded with Curcumin for the Ovarian Cancer Therapy

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Abstract : In this study, we have prepared concanavaline A (ConA) functionalized curcumin (CUR) loaded PHBHHx (poly(3-hydroxybutyrate-co-3-hydroxyhexanoate)) nanoparticles as a novel and efficient drug delivery system. CUR is a promising anticancer agent for various cancer types. The aim of this study was to evaluate therapeutic potential of curcumin loaded PHBHHx nanoparticles (CUR-NPs) and concanavaline A conjugated curcumin loaded NPs (ConA-CUR NPs) for ovarian cancer treatment. ConA was covalently connected to the carboxylic group of nanoparticles by EDC/NHS activation method. In the ligand attachment experiment, the binding capacity of ConA on the surface of NPs was found about 90%. Scanning electron microscopy (SEM) and atomic force microscopy (AFM) analysis showed that the prepared nanoparticles were smooth and spherical in shape. The size and zeta potential of prepared NPs were about 228±5 nm and −21.3 mV respectively. ConA-CUR NPs were characterized by FT-IR spectroscopy which confirmed the existence of CUR and ConA in the nanoparticles. The entrapment and loading efficiencies of different polymer/drug weight ratios, 1/0.125 PHBHHx/CUR= 1.25CUR-NPs; 1/0.25 PHBHHx/CUR= 2.5CUR-NPs; 1/0.5 PHBHHx/CUR= 5CUR-NPs, ConA-1.25CUR NPs, ConA-2.5CUR NPs and ConA-5CUR NPs were found to be ≈ 68%-16.8%; 55%-17.7 %; 45%-33.6%; 70%-15.7%; 60%-17%; 51%-30.2% respectively. In vitro drug release showed that the sustained release of curcumin was observed from CUR-NPs and ConA-CUR NPs over a period of 19 days. After binding of ConA, the release rate was slightly increased due to the migration of curcumin to the surface of the nanoparticles and the matrix integrities was decreased because of the conjugation reaction. This functionalized nanoparticles demonstrated high drug loading capacity, sustained drug release profile, and high and long term anticancer efficacy in human cancer cell lines. Anticancer activity of ConA-CUR NPs was proved by MTT assay and reconfirmed by apoptosis and necrosis assay. The anticancer activity of ConA-CUR NPs was measured in ovarian cancer cells (SKOV-3) and the results revealed that the ConA-CUR NPs had better tumor cells decline activity than free curcumin. The nacked nanoparticles have no cytotoxicity against human ovarian carcinoma cells. Thus the developed functionalized nanoformulation could be a promising candidate in cancer therapy.

Keywords : curcumin, curcumin-PHBHHx nanoparticles, concanavalin A, concanavalin A-curcumin PHBHHx nanoparticles, PHBHHx nanoparticles, ovarian cancer cell
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