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Lipid-polymer hybrid nanoparticles (Lipobrid) based targeted delivery of Docetaxel to breast cancer cells

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More than 10 million patients are diagnosed with new cases of cancer every year and approximately 30 million new cases of cancer will have been recorded by 2030. While cytotoxic chemotherapeutic agents such as Docetaxel (DTX) and Doxorubicin (DOX) efficiently kill cancer cells, they cannot differentiate cancer cells from normal cells. This lack of selectivity leads to unwanted systemic toxicity when patients are exposed to the cytotoxic agents. Improving the selectivity of anticancer drug delivery to cancer cells and the tumor microenvironment while sparing normal cells and tissues is a major challenge in the effective treatment of cancers of various tissues and organs. Marked differences are found in cancer cells and tissues in terms of biochemical, molecular and physiological features when compared with normal cells and tissues such as differences in redox status, pH levels, expression of certain cell membrane receptors, the leakiness of tumor tissues and the tumor vasculature. Therefore, in this study, we exploit some of these differences cancer stands out as a disease likely to benefit from targeted drug delivery approaches. In this study, we formulate and developed surface decorated lipid polymer hybrid nanoparticles of Docetaxel for targeted delivery to breast cancer. Fu-LPHNPs were prepared using the single step nanoprecipitation method. Fu-LPHNPs comprised of poly (D, L-lactide-coglycolide) (PLGA) core, a soybean lecithin monolayer and (1, 2-distearoyl-sn-glycero-3-phosphoethanolamine-N-carboxy (polyethylene glycol) 2000-Fucose) (DSPE-PEG_{2k}-Fu) targeting ligand. For LPHNPs (non-targeting control), DSPE-PEG_{2k}-FOL was replaced by DSPE-PEG_{2k}. Fu-LPHNPs exhibited good monodispersity, excellent size, stability and a well-defined core-shell structure. Flow cytometry, confocal image and MTT assays revealed that Fu-LPHNPs further enhanced cell uptake via lectin receptors mediated endocytosis and resulted in higher cytotoxicity against human breast adenocarcinoma cells (MCF-7) than non-targeted controls (LPHNPs).

Biography

Rajesh Singh Jadon is currently pursuing PhD in Pharmaceutical Sciences from Jiwaji University, Gwalior, India. Currently, he is working on development and evaluation of nanocarriers for targeted delivery of bioactives. He has authored more than 15 research and review articles and two books related to drug delivery systems. He is also a Member of various professional bodies like Controlled Release Society, Indian Immunology Society, APTI and Association of Registered Pharmacists. He has around 12 years of experience in research, evaluation, teaching and administration in educational institutions.

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