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Targeted drug delivery in cancer with multifunctional nanoparticles

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Nanoparticle based drug delivery is attracting growing interest with several drug products on the market. Advantages of nanoparticles (NPs) include improved solubility and stability, sustained release, increased accumulation in cancer cells, decreased side effects, combination therapy for synergistic effect or reversal of multi-drug resistance, and theranostic use. Our objective is to design suitable drug delivery systems which can deliver anticancer drugs specifically to the cancer cells in sufficient concentrationand avoid the side-effects of anticancer drugs. We have developed few NPs systems in our laboratory for drug delivery in cancer such as targeted polymeric NPs, p-glycoprotein inhibiting micelles and platelet-shaped inorganic layered zirconium phosphate (ZrP) NPs. The targeted biodegradable polymeric NPs were used to deliver 17-allylamino-17-demethoxy geldanamycin (17-AAG), an inhibitor of heat shock protein 90 (HSP90). Poor water solubility, short half-life and hepatotoxicity effected its clinical use. The micelles were used for delivery of 17-AAG and other agents. The targeted NPs and micelles showed higher intracellular uptake and increased cytotoxicity in sensitive and multidrug resistant cancer cells. The platelet-shaped ZrP NPs are capable of intercalating a high load (35% w/w) of the model anti-cancer drug, doxorubicin (DOX) into their layered structures and sustained the release of DOX for two weeks. DOX loaded ZrP NPs showed higher cellular uptake and increased cytotoxicity in sensitive and metastatic breast cancer cells. These multifunctional nanoparticle systems, due to their biocompatibility, targeting ability, high drug loading and controlled release behavior, might be developed as drug delivery system for advanced cancer therapy.

Biography

Muhammad Delwar Hussain is Professor of Pharmaceutics, California Health Sciences University. He received his Ph.D. from University of Alberta, Canada. His research focuses on drug delivery, nanomedicine, pharmacokinetics and cancer therapeutics. He has more than 100 publications, and several federal, foundation and industrial grants. His work in pharmaceutical industries led to marketed products such as Eligard® for prostate cancer. He is invited speaker for scientific meetings. He is associate editor and editorial board member of several journals. He has served as United States Pharmacopeia (USP) as expert committee member. He is currently the Chair-elect of Pharmaceutics Section, American Association of Colleges of Pharmacy (AACP).

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