Acta Scientific Pharmaceutical Sciences (ISSN: 2581-5423)

Volume 5 Issue 3 March 2021

Short Communication

Novel Nanocarrier based Drug Delivery Systems for Cancer Therapy

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Received: February 13, 2021

Published: February 25, 2021

Cancer is one of the leading causes of death worldwide. Despite efforts to alleviate risk factors in recent decades, the incidence of cancer is continuing to increase [1]. As cancer cells grow faster than healthy ones, fast-growing cells are the main targets of chemotherapeutics. The limitations of conventional chemotherapy have led to the development of nanocarrier-based drug delivery systems which target drugs to specific sites [2]. Nanocarriers can improve drug efficacy and selectivity through enhanced permeability and retention (EPR) effects in tumor cells. Among the nanocarriers, liposomes, polymeric nanoparticles, and micelles have received the most attention. So far, numerous nanoparticle-based chemotherapeutics are clinically approved whilst others are in the advanced stages of clinical development [3]. Depending on the sorts and applications of nanocarriers, there are a few steps to convert ordinary nanocarriers into novel and particular. First, nanocarriers face many biological barriers, including cleansing by the reticuloendothelial system (RES) on the way to the targeted site. PEGylation is a unique technique to avoid this cleansing process and it help nanocarriers to escape the RES. Second, nanocarriers can be functionalized to identify the cancer cells precisely out of healthy ones. The surface of cancer cells over expresses some proteins. Nanocarriers are modified with ligands matching the over expressed proteins. The ligands of nanocarriers identify the cells with the receptor proteins [2].

A liposome is a spherical-shaped vesicle that is composed of one or more phospholipid bilayers, which closely resembles the structure of cell membranes. The ability of liposomes to encapsulate hydrophilic or lipophilic drugs has allowed these vesicles to become useful drug delivery systems. Liposomes have been considered to be the most successful nanocarriers for drug deliver and have made their way to the market. Liposomes overcome the limitations of conventional chemotherapy by improving the bioavailability and stability of the drug molecules and minimizing side effects by site-specific targeted delivery of the drugs. Doxil (US) or Caelyx (outside-US) is a PEGylated liposomal formulation encapsulating anticancer drug doxorubicin commercialized by Johnson and Johnson. LipoDox is the same liposomal formulation as Doxil in USA and made in India by Sun Pharma and in 2013, FDA approved the first generic version of Doxil, made by Sun Pharma [4]. Polymeric nanoparticles (NPs) are particles within the size range from 1 to 1000 nm and can be loaded with active compounds entrapped within or surface-adsorbed onto the polymeric core [2]. The polymeric drug-loaded nanoparticles have been viewed as a novel promising strategy for cancer treatment because they not only can improve the drug pharmacokinetics but also further response to the permeation and retention (EPR) effect to enhance the accumulation of drugs at the site of the tumor during cancer treatment. The recent research hotspot of polymers utilized for drug loaded nanoparticles include poly (D, L-lactic-co-glycolic acid) (PLGA), polylactic acid (PLA), poly (ethylene glycol) (PEG), chitosan (CS), and hyaluronic acid (HA), etc [5].

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