Nanoformulations for cancer therapy

Cancer is a major disease responsible for death in human beings. A lot of research has been performed to develop improved diagnostic tools as well as drugs to treat cancer. Effectiveness of therapeutics in cancerous malignancy is dependent on ability of a therapeutic agent to kill cancer cells. At the same time chemotherapeutic should cause minimum toxicity to normal cells. A lot of research is being carried out on delivery systems that can target therapeutic drugs specifically to tumor site. Oftentimes cancer chemotherapy is not successful due to i) high side effect/toxicity to normal cells and tissues (ii) development of enhanced drug resistance in cancer cells due to high expression of proteins like efflux transporters (P-glycoprotein, multidrug resistance Protein etc) in cancer cells. Drug resistance leads to lower accumulation of drugs in cancer cells. Most anti-cancer drugs are substrates of efflux pumps. Efflux transporters pumps out therapeutic drugs from cancer cells as a result lowering bioavailability. Low bioavailability leads to increase in amount of drug needed to achieve drug concentration needed to destroy cancer cells. This causes toxicity to normal cells. Hence there is need for development of drug delivery platforms which will deliver cancer therapeutics specifically to cancer cells. Targeted drug delivery systems will deliver chemotherapeutics preferentially to cancer cells thereby causing selective toxicity to cancerous cells. In addition, targeted drug delivery would minimize toxic side effects to normal healthy cells. As a result, this would lower the required dose to be delivered reducing side effects and enhancing patient compliance. Targeted drug delivery also allows evasion of efflux pumps thus addressing the issue of drug resistance.

Nanoparticles are an emerging technology which is a subject of active research. A lot of interesting and clinically significant investigations involving nanoparticle technology are under process. Due to the above mentioned reasons there is a need to have an understanding of the direction drug delivery for cancer chemotherapy is evolving. Size of Nanoparticle varies in the region of 5–100 nanometers. There are numerous components from which nanoparticles can be prepared. Nanoparticles can be prepared from polymer like Poly-lactide-co-glycolide (PLGA), and Poly-caprolactone (PCL). Other than polymers nanoparticles are also made up of metals like gold, iron, silver, and other components such as silica. Due to different components used to prepare nanoparticles, there are many possible functional groups present on the surface of the nanoparticles. Many targeting agents can be conjugated on the surface or in the core of nanoparticles. Nanoparticles can prevent rapid metabolism and clearance which leads to sustained delivery of therapeutics. Nanoparticles may improvement therapeutic index of drugs by increasing efficacy of the drug and enhance tolerability of therapeutic drugs. In addition, nanoparticle has the potential to enhance bioavailability of hydrophobic drugs, hence minimize delivery concerns associated with hydrophobic drugs.Nanoparticles which have been functionalized with targeting moieties may be used to deliver therapeutic drugs to intended site of action. This leads to lowering of side-effects associated with most therapeutic regimen. This review focuses on patent which have been approved for nanoparticle and other nanoformulations developed for cancer therapy.

Publication

Recent patents on nanoparticles and nanoformulations for cancer therapy.
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