Nanotechnology based anti-cancer drug delivery systems: current developments and perspectives

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Low aqueous solubility, unfavourable pharmacokinetics, poor biodistribution profiles and toxicity issues are frequent problems that prevent full exploitation of the therapeutic potential of anticancer drug. Nanotechnology based drug delivery systems have been developed as strategies to overcome many of the obstacles that are associated with conventional formulations. The principle aim of using advanced drug delivery systems in pharmaceutical delivery is to enable efficient delivery at the appropriate level of therapeutic agents to the target sites with reduced side effects to the patient. Given the benefits that nanotechnology offers, much effort has focused on producing nanoparticles for the delivery of anticancer drugs. These nanosystems can be modified to achieve desirable biological properties like long circulation in the blood stream or targeting properties.

Nucleic acids play an increasingly important role in our arsenal of therapeutic agents. Delivery of these molecules to their site of action at the desired rate is a challenge because their transport through compartmental barriers in the body is inefficient and because they are readily metabolized. For controlled release or site-specific delivery of such molecules, specific delivery systems are required. Those systems must be custom-made, taking into account both molecular size and specific characteristics of these molecules.

A vast array of nano-sized delivery systems have been developed and these are largely formed from polymer and lipid materials. The lipid-based systems include liposomes, poly(ethylene glycol)–lipid micelles and lipid–drug complexes, while the polymer-based delivery vehicles comprise nanoparticles, nanospheres, polymer–drug conjugates, block copolymer micelles, block copolymer vesicles as well as others

This presentation will focus on reviewing two of these advanced drug delivery strategies, liposomes and polymeric nanoparticles. These strategies are actually developed in the laboratory of Pharmaceutical Technology for the administration of anticancer drugs as well as for the administration of nucleic acids.

The presentation will review how the fundamental physicochemical properties of a nanomedicine (its size, charge, hydrophobicity, etc.) can dramatically affect its biodistribution and activity. Examples of formulations developed in the laboratory will illustrate this presentation.

Finally, this presentation will also examine some of the approved nano-sized delivery systems